#4 Letter 4-23-03

THE AEROSPACE CORPORATION

RECEIVED
MAY 25 2001
Technology Center 2600

Cnli9901.375
November 10, 2000

OIPE JC46
MAY 17 2001
PATENT & TRADEMARK OFFICE

RECEIVED
MAY 24 2001
OIPE/JCW5

Confirmatory License

Application For: Laser Communications Crosslink System

Inventor(s): M. A. Rolenz

Serial No.: 09/577,221 Contract No.: F04701-93-C-0094

Filing Date: 05/23/00 Contractor: The Aerospace Corporation

The invention identified above is a "Subject Invention" under Patent Rights clause FAR 52.227, which is included in Contract No. F04701-93-C-0094, with the Department of the Air Force. This document confirms the rights acquired by the Government through the referenced clause, including a paid-up license in this invention, corresponding patent applications and in any resulting patents.

The Government is hereby granted an irrevocable power to inspect and make copies of the above-identified patent application.

Signed this 16th day of November 2000

Contractor: The Aerospace Corporation

By: _____
Gordon J. Louttit
Senior Vice President, General Counsel and Secretary

Business Address: P.O. Box 92957, M1/040
Los Angeles, CA 90009

99-01

INVENTION DISCLOSURE

IN DISCLOSING THE INVENTION

1. Discuss the problem which the invention is designed to solve, referring to any similar devices.
2. State the advantages of the invention over devices presently known.
3. Describe the invention and its operation. If necessary, attach signed, witnessed and dated prints, etc.
4. List the features of the invention that are believed to be novel.
5. Have you publicly disclosed this invention? If yes, when? A valid patent cannot be obtained if the invention was publicly disclosed more than one year prior to the filing of a patent application.
6. Describe potential markets for this patent.
7. Send this disclosure to the Corporate Law Directorate.

~~asdfaed aedf wrewer asdf~~

See Attached (3 pages)

PLEASE WRITE SIGNATURES AND DATES IN BLACK INK

INVENTOR	DATE	INVENTOR	DATE	INVENTOR	DATE
	1/15/99				
ORGANIZATION AND CCC		ORGANIZATION AND CCC		ORGANIZATION AND CCC	
Comm. Sys. & Sol. V. 5232					
WITNESSED, READ AND UNDERSTOOD BY: Wayne Fenner	DATE: 1/15/99	AND BY: Albert M Young		DATE: 1/15/99	

AEROSPACE FORM 125 REV 8-94

JAN 18 1999

Integrated Laser Crosslink and analog-to-digital convertor for transmission of signals

Inventor: M.A.Rolenz #17684 13 January, 1999

IN DISCLOSING THE INVENTION

1. Discuss the problem which the invention is designed to solve, referring to any similar devices.

Laser crosslinks do not transmit analog signals directly very well. Analog signals must be converted to digital samples and the bits transmitted using some form of digital modulation (e.g., phase shift keying or on-off keying). Small satellites (e.g., nanosatellites) are not able to generate much power because of their small size. Use of laser crosslinks is desired to transfer received signals to another satellite for processing. Low power components, and reduction of components are required to meet the stringent power requirements. Furthermore, reduction of the numbers of component is desired to increase reliability and reduce fabrication complexity. The problem is to transmit these digital sample with as few components as possible.

2. State the advantages of the invention over devices presently known.

The traditional approach to transmitting digitized information over a crosslink is to multiplex the parallel output of the analog to digital converter into a ordered serial data stream. Add redundant bits into the bit stream for synchronization and error correction/detection. This invention eliminates the need for additional synchronization and error correction/detection since it is oversampling and self synchronizing.

This invention requires fewer parts and less power by integrating the Analog to digital conversion and transmission into one system. By using sigma-delta conversion, it reduces the roll-off requirements and manufacturing tolerances for anti-aliasing filters in the front of the analog to digital converter of the satellite transmitting the crosslink signal reducing, manufacturing tolerances and required performance.

It simplifies laser crosslink design over traditional PSK by direct modulation of the laser by the data stream.

3. Describe the invention and its operation. If necessary, attach signed, witnessed and dated prints, etc.

In this invention, the output sigma-delta modulator of a traditional analog-to-digital converter (+/-1 output) is converted to on-off (0,1) signal and then input to the on-off laser modulator. This laser is used as a crosslink to another satellite. This satellite has a simple detector which determines when the received signal from the laser is on or off. This binary signal is converted to +1 or -1 and input to a the digital filter (as in the other half of the sigma delta analog to digital converter). By changing the clock speed, order of the sigma delta modulator on the transmitting satellite, and the size of the decimating digital filter on the receiving satellite, nearly any number of A/D bits of resolution (up to the bit capacity of the laser cross link) can be realized. The link may operate at high resolution and low capacity or low resolution and high capacity. If these are made variable parameters, then the invention allows the crosslink to be adapted for the type of data without requiring different hardware.

If the output of the laser detector is a continuous voltage rather than a 0 or 1, then this may be converted to an n-bit digital word between [-1,1] to implement soft decision type of algorithms for the interpolation function.

4. List the features of the invention that are believed to be novel.

In the sigma-delta analog-to-digital converter, the sigma-delta modulator and digital interpolating filter are an integrated package. In this invention, the two are placed at physically separated locations

communication path between them provided by a laser crosslink. This system integrates a sigma-delta analog to digital converter with a laser crosslink to simplify the design of both. The high bandwidth available from the crosslink (NOTE: this is applicable to FIBER OPTICS AS WELL) permits the direct transmission of the oversampled data stream output by the sigma-delta modulator. Since that output is oversampled already, this eliminates the normally required synchronization and error correction detection on the digital link. Since the digital sample is reconstructed using a digital filter filtering a continuous stream of data, it is less susceptible to errors in the transmission of data than in traditional framed data where the probability of error for bits is the same but the effects of errors is more severe with the most significant bits.

5. Have you publicly disclosed this invention? If yes, when? A valid patent cannot be obtained if the invention was publicly disclosed for
more than one year prior to the filing of a patent application.

No.

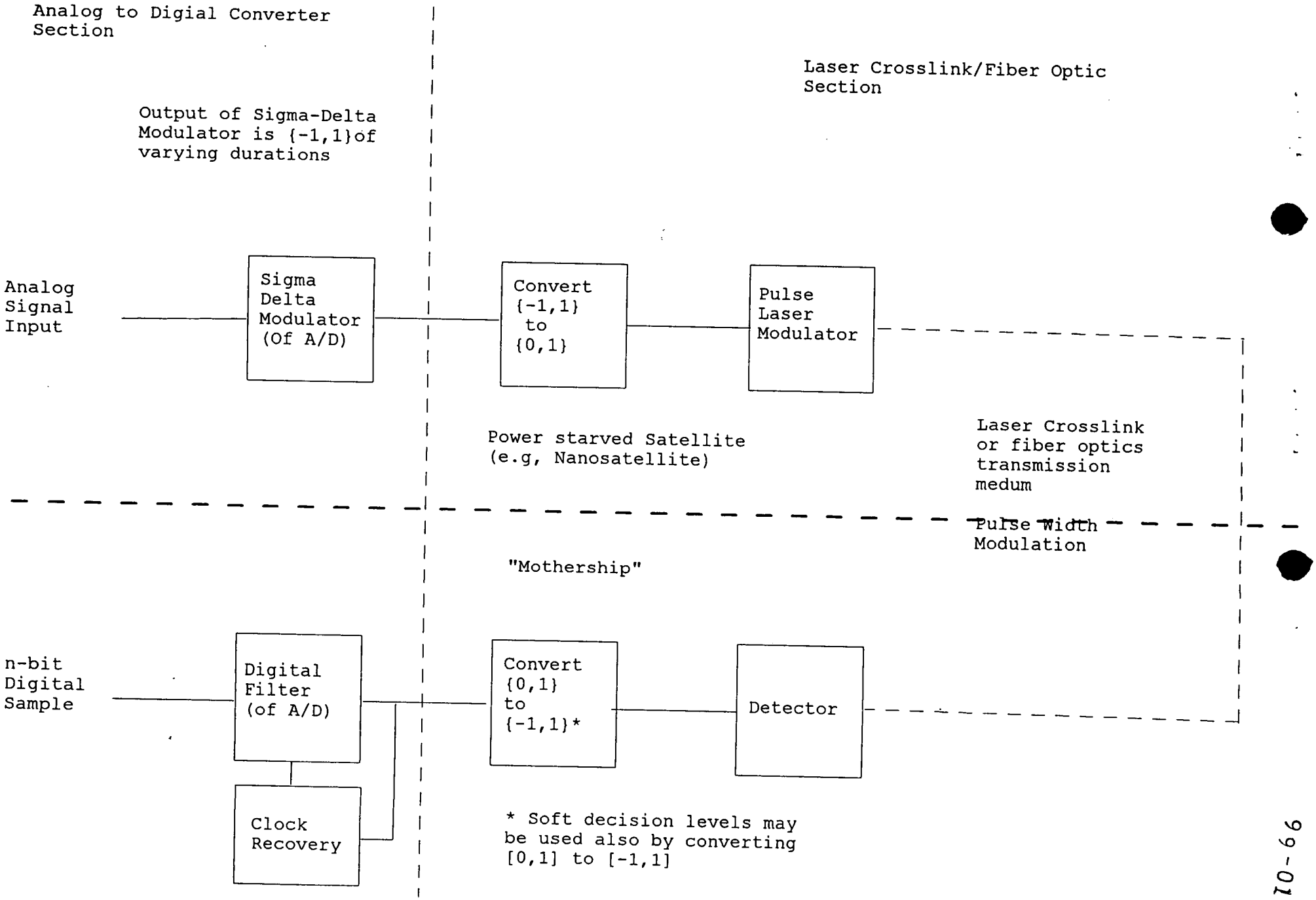
6. Describe potential markets for this patent.

Satellite communication systems employing crosslinks or fiber optics where digitized information such as voice, received radio signals is being transmitted to another location or satellite. One application of small satellites is a constellation of satellites containing signal receivers using nanosatellites. The digitized samples of the received signals to other satellites for processing over a laser crosslink.

Other uses include signals intelligence collection, digital nonregenerative transponders, fiber optics.

Collection of low bandwidth signals with high resolution at low power levels.

7. Send this disclosure to the Corporate Law Directorate.


Analog to Digial Converter Section
Laser Crosslink/Fiber Optic Section
Output of Sigma-Delta Modulator is {-1,1}of varying durations
Analog Signal Input
Sigma Delta Modulator (Of A/D)
Convert {-1,1} to {0,1}
Pulse Laser Modulator
Power starved Satellite (e.g, Nanosatellite)
Laser Crosslink or fiber optics transmission medum
Pulse Width Modulation
"Mothership"
n-bit Digital Sample
Digital Filter (of A/D)
Convert {0,1} to {-1,1}*
Detector
Clock Recovery
* Soft decision levels may be used also by converting [0,1] to [-1,1]